H2DI HYDROGEN DEMAND INITIATIVE

H2DI Overview and Preliminary Demand Support Program

NOVEMBER 2024

AMMONIA ENERGY ASSOCIATION ANNUAL CONFERENCE

H2DI HYDROGEN DEMAND INITIATIVE

The Role of Demand in Clean Commodity Markets

The Hard Truths of Nascent Markets

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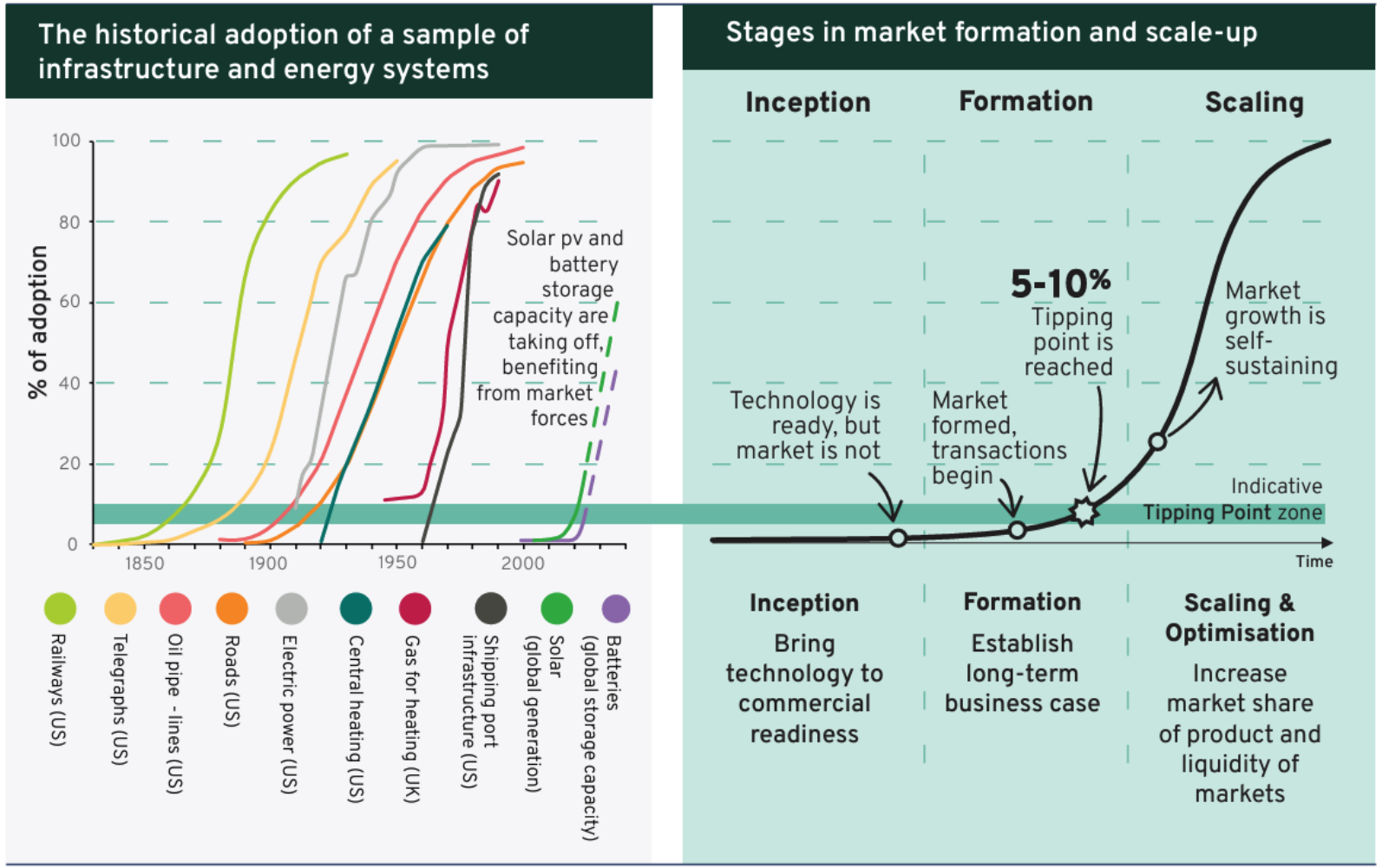
It's all about Getting to the Tipping Point

- The trajectory for new technologies and early-stage markets is well established
- Once the tipping point has been reached, market demand for new technologies drives the costs of the technology lower, driving further demand for the technology, creating a self-sustaining market momentum
- Yet the toolkit to buy-down and speed-up the path to the Tipping Point is still under-development.
- Globally, governments and industry are innovating to create new approaches to buy-down and speed-up the S-Curve



Source: Mission Possible Partnership, *Unleashing Market Forces to Scale Green Industry: The Role of Green Market Makers*

Bankable demand is a key ingredient needed to move nascent markets forward, and we see this in the clean hydrogen market

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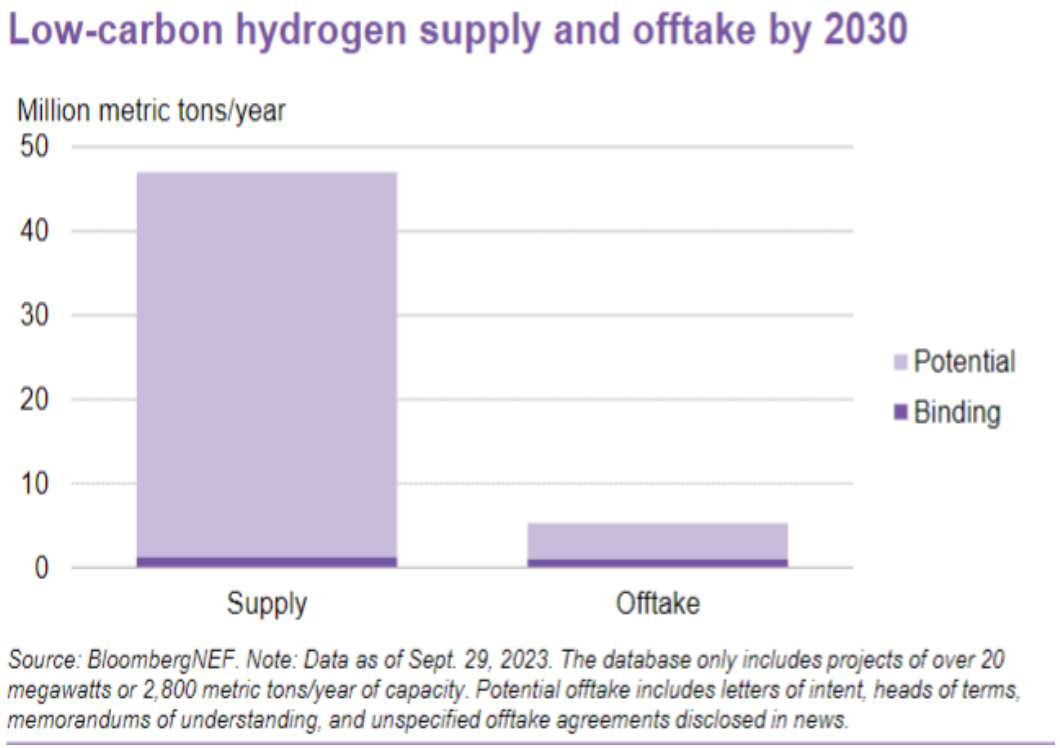
Only ~10% of announced clean hydrogen supply have found potential buyers



Source: BloombergNEF. Note: Data as of Sept. 29, 2023. The database only includes projects of over 20 megawatts or 2,800 metric tons/year of capacity. Potential offtake includes letters of intent, heads of terms, memorandums of understanding, and unspecified offtake agreements disclosed in news.

To reach Final Investment Decision, investors require offtake agreements and financeable project structures

> Today, investments in production outpace offtake, and **many offtakers are hesitant to sign long-term contracts.**
>
> Hydrogen Council

> **Demand is the key bottleneck limiting the scale up of the hydrogen industry in the near term**
>
> Bloomberg NEW ENERGY FINANCE

Friction on the Demand-Side Isn't One Dimensional

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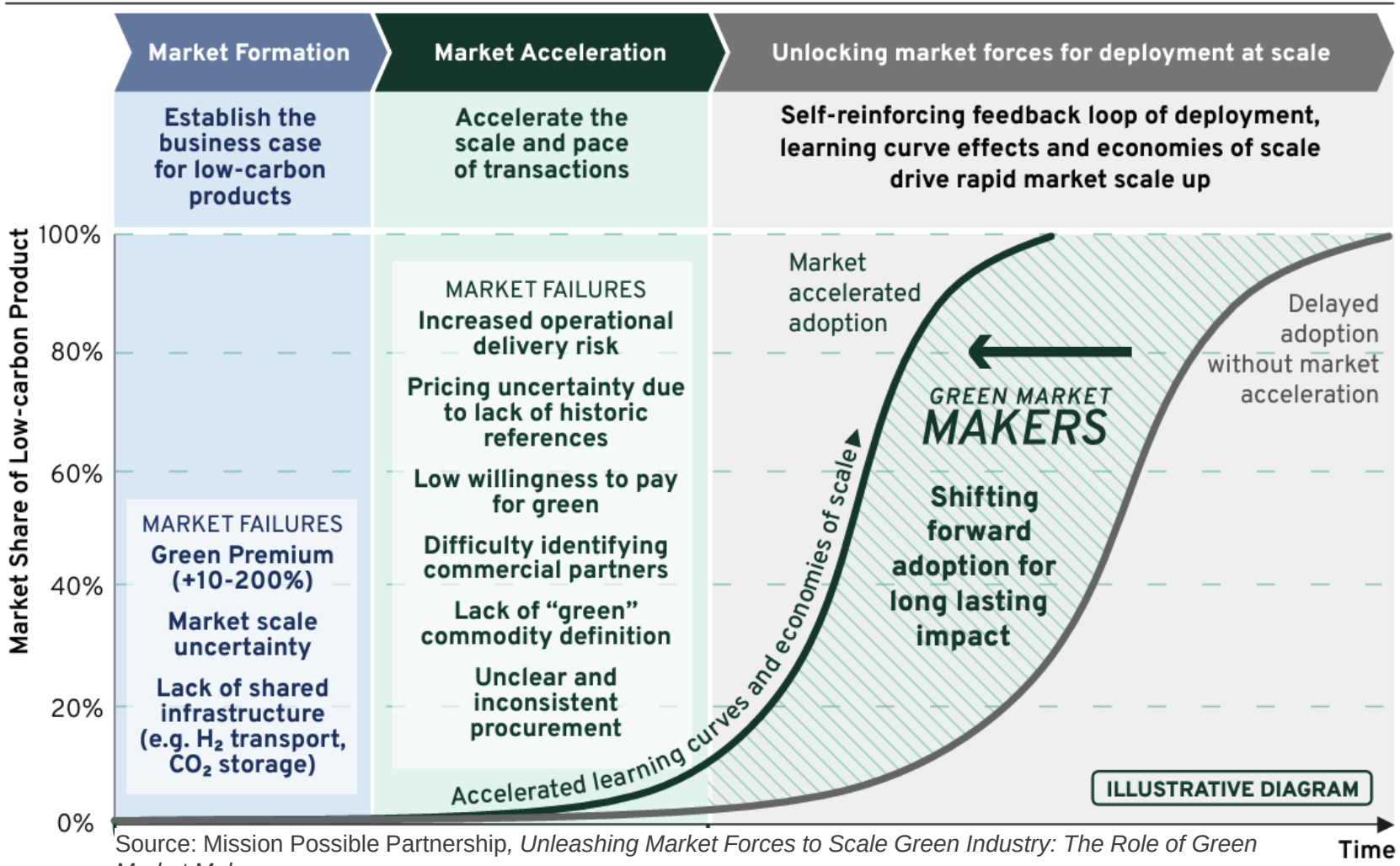
Nascent markets suffer from a variety of challenges, each of which requires a different remedy



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Government and Industry Support for the Demand Side is Emerging

1. Corporate Purchasing Targets and Pledges

81

CLIMATE GROUP CONCRETE ZERO

CLIMATE GROUP STEELZERO in partnership with Responsible Steel

81 members have set purchasing commitments for low-emissions steel and cement

98

First Movers Coalition

98 members have made 120 commitments collectively across sectors, including shipping, aviation, cement, steel, trucking, and aluminum

2. Voluntary Buyers Platforms

450+ members

SUSTAINABLE STEEL BUYERS PLATFORM

CEBA Clean Energy Buyers Association

ZEMBA

SABA SUSTAINABLE AVIATION BUYERS ALLIANCE

3. Government Demand Support

Funding for Hydrogen-based programs

H2DI/DOE

$2B

European Hydrogen Bank

$2B

UK H2 Business Model

$6B

H2Global (Germany)

$21B

Japan Clean H2 Subsidies

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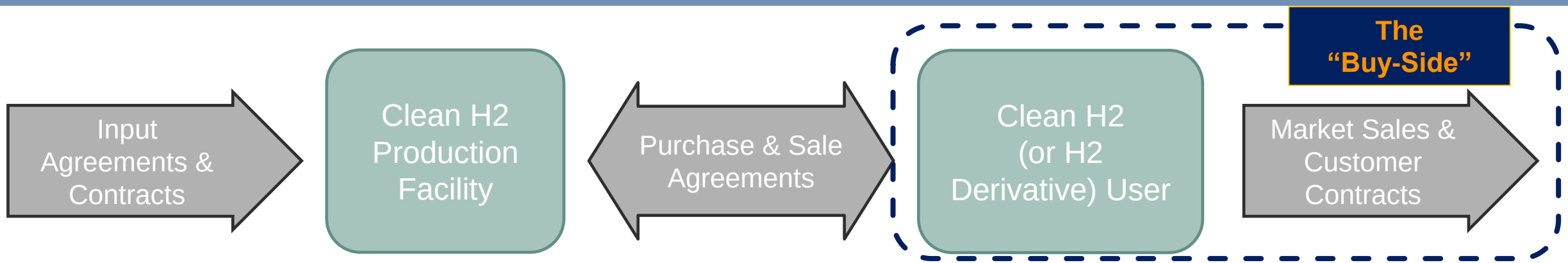
Buying Down Early Market Risks: Finding the Best Use of Public Dollars



Offtake Agreements and Risk
- Tenor
- Price
- Volume
- Quality/Purity
- Counterparty Risk/Stake

Delivery Contracts and Risk
- Infrastructure Access
- Fleet availability
- Technical Risk

Construction Risk

Operational Risk

Technology Risk

Feedstock Risk

Policy/Regulatory Risk

Equipment/OEM Risk

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Market Risk

Counterparty Risk

Green Premium/EAC Risk

Policy/Regulatory Risk

Performance/Quality Risk

H2DI Focus

Potential mechanisms to address demand challenges

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Mechanism Type	Description	Examples
Volumetric price support	Provide a fixed amount of support for a certain quantity of hydrogen	• $/kg subsidy / discount (similar to EU Hydrogen bank) • Buyer Aggregation
Price Hedges	Offer price certainty, either to buyer or supplier	• Contracts-for-Difference (CfD) • Price ceiling/floor for buyers/sellers respectively • Environmental attribute hedge (e.g., LCFS price guarantee) • Offtake backstop
CapEx Support	Defray the cost of equipment needed for clean hydrogen adoption	• CapEx "buydown" for projects • Buyer Aggregation End-Use Equipment (e.g., fleet vehicle purchases)
Midstream / Storage support	Derisk common-use midstream / storage assets through capacity reservations / payments	• Pipeline capacity reservation • Incentives for 3rd party pipeline access • Storage or bunkering capacity reservation
Buy-Side Capacity Building and Other support	Execute ancillary activities / mechanisms that can support offtake	• Marketplaces and Matchmaking Platforms • Support buyer aggregation efforts • RFPs as a Service • Education and Standards to Support Deals

Buying Down Early Market Risks: Finding the Best Use of Public Dollars

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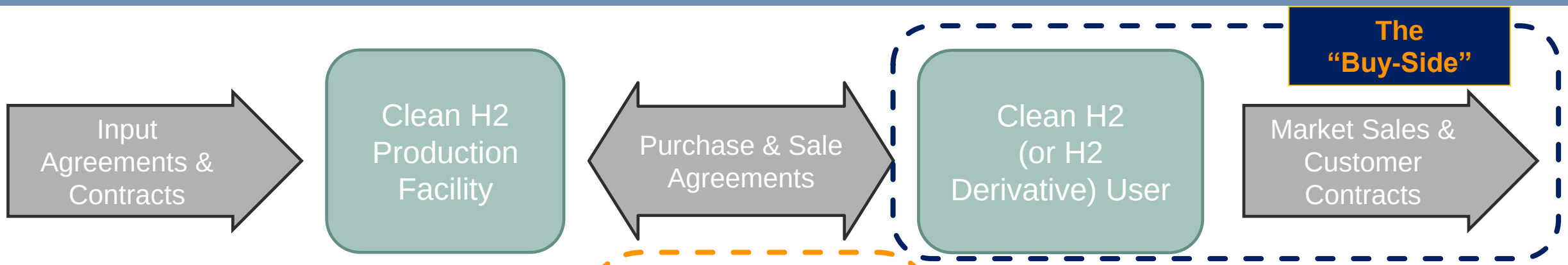

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Current H2DI Tier 1 and Tier 2 Mechanisms

H2DI Focus

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H2DI Overview

A Dual Mandate —DOE selected H2DI to design a demand-side program for the H2Hubs and the US Clean Hydrogen market

H2DI's funding is part of the $8 billion Regional Clean Hydrogen Hubs program funded by the Bipartisan Infrastructure Law (BIL). H2DI exists to provide **demand-side support** to the clean hydrogen market by leveraging private investment with targeted federal resources.

Our primary imperative:
De-risk H2Hub projects

- Drive down costs, reduce project risk
- Unlock FID that would not have been otherwise possible
- Given capped funding, can only support a handful of small projects

Our related objective:
Catalyze broader market maturity

- Facilitate price transparency and contract standardization (publishing key terms and conditions)
- Support projects to come online faster, aiding in development of a voluntary market for low-carbon commodities

Two Parts to DOE's First Demand-Support Program

Designing the Optimal Delivery Vehicle for a Demand-Support Program

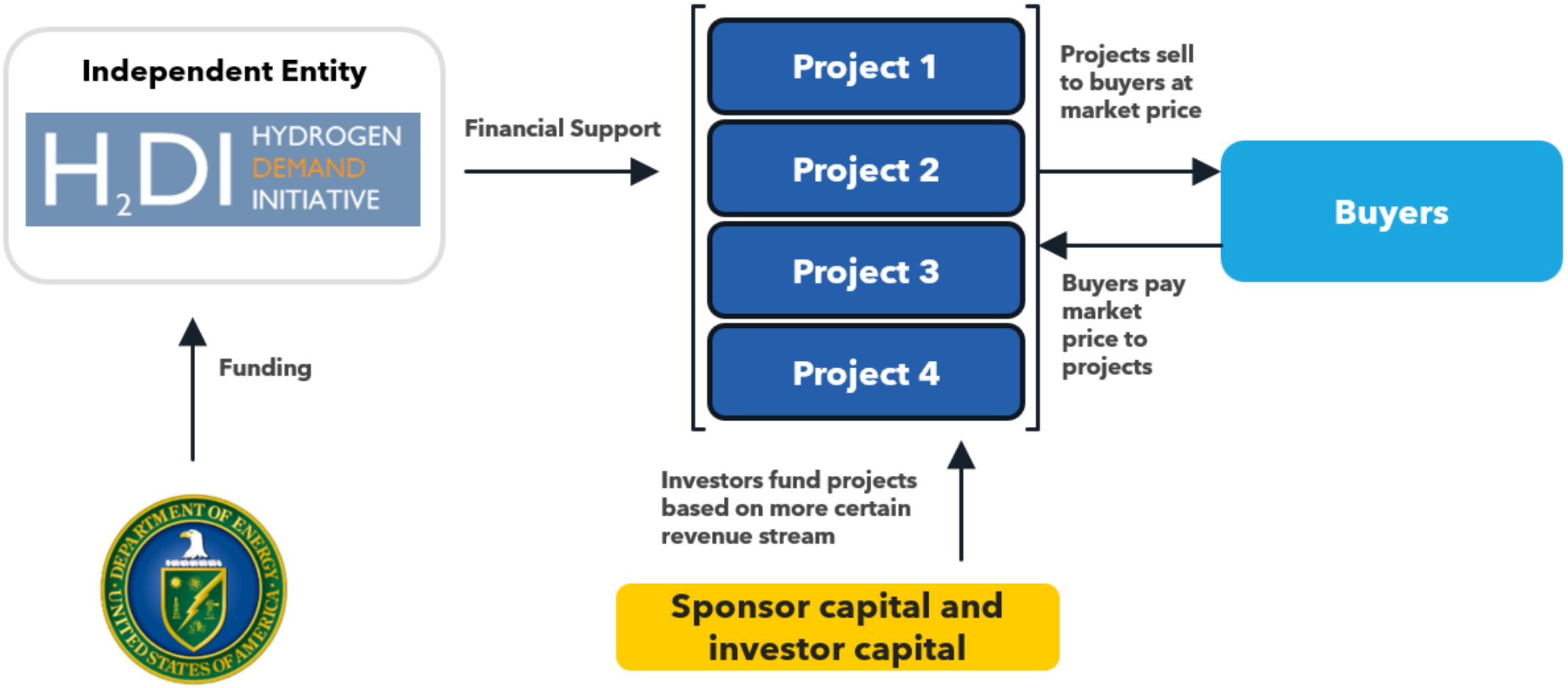
Develop a model for program delivery that can meet the needs needs of buyers and address demand-side challenges while effectively deploying federal funding

Designing the Demand-Support Investment and Engagement Strategy

Develop financial mechanisms and buyer engagement strategies to unlock early-stage projects and support increased offtake of clean hydrogen

H2DI is also designing an Independent, Gov't-sponsored Nonprofit that will offer commercial-style contracts with projects

Conceptual illustration of demand-side support initiative



New Non-Profit model is an opportunity to expand DOE's toolkit to meet the needs of nascent markets for clean commodities

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- Other Transactions (OT) authority facilitates new vehicles for DOE funding
- Demand-side support lengthens DOE's support beyond the demo stage
- Demand-side model and process could be replicated for other low-carbon commodities
- Pay-for-performance contracts diversify from upfront, CAPEX-focused support
- Establishing a non-gov'tal intermediary brings in private-sector expertise

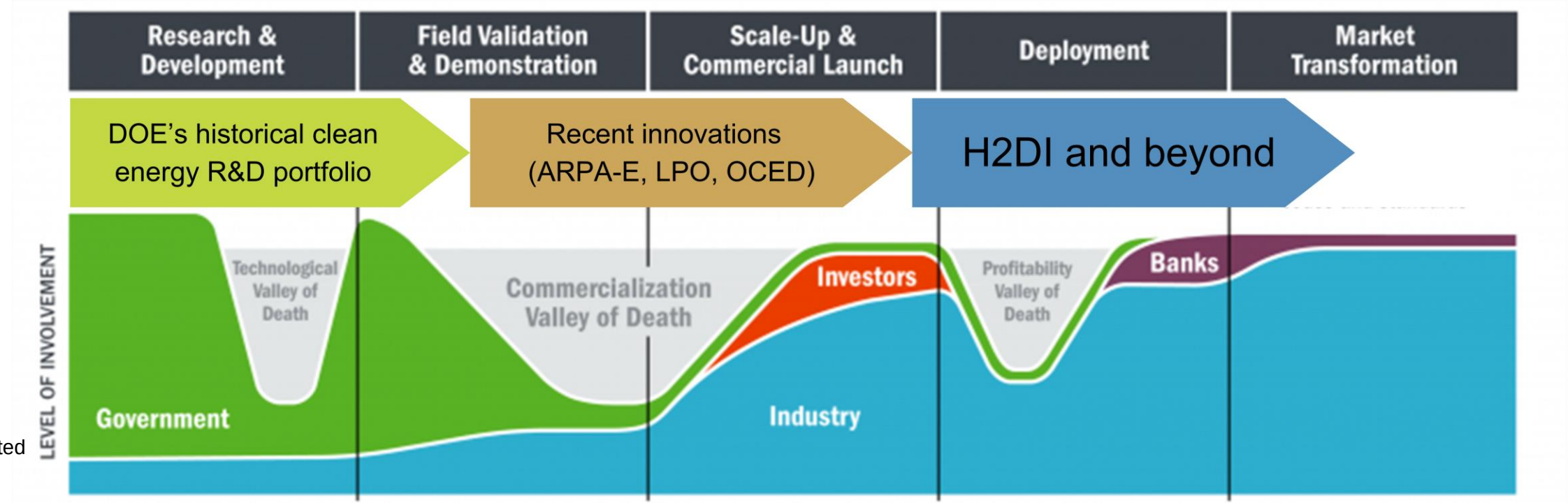

Figure adapted from OTT

This nonprofit design draws on precedents in the federal government, private sector, and global clean hydrogen programs

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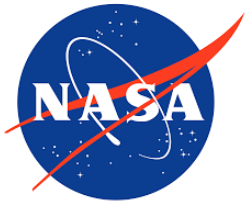

International demand-side support for H2	Corporate demand-side support	Agency-sponsored nonprofits	In-Q-Tel (CIA "VC" firm)	Prior uses of Other Transactions	Other federal demand-side support
• Gov't-sponsored independent counterparties in UK, Germany	• Public-private collaborations (Mission Possible) • Buyers' clubs (SABA, ZEMBA) • Advance market commitments (Frontier)	• Combine public and phil. funding • Largely focused on RD&D • Examples at FDA, CDC, DoD, DOE, NIH, USDA	• Unique agency-sponsored commercial enterprise • Sole funding from single federal contract	• Novel public-private partnerships • NASA Space Act Agreements (SpaceX) • DARPA OTs (UAV prototypes)	• Defense Production Act use for vaccines and ventilators

Federal government precedents

The team has developed a prioritization process to determine the most impactful mechanisms

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1. Multiple Hubs?
2. Sizeable Potential Market?
3. Compatible Capital Requirements?
4. Outperforms Competing Alternatives?
5. Ecosystem Enabling?

= H_2DI Priorities

Projects that are focus areas for multiple hubs

Attractive near- (2030) and long- (2040+) term TAM

Appropriate capital requirements (considering $500M+ budget)

Portfolio-based approach to risk management

Low risk of being overtaken by cheaper, clean alternatives

Price transparency

Crowding in private capital

Addresses industry's creditworthiness

Targets regional incentives

H2DI conducted 600+ engagements with stakeholders across the value chain to gather insights into the state of the H_2 ecosystem

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METHODS OF ENGAGEMENT

- Semi-structured interviews to answer targeted questions on auction terms and conditions
- Industry Workshops/Webinars
- Hub Bilaterals
- Hub Liaison Councils
- Conferences
- Data Call

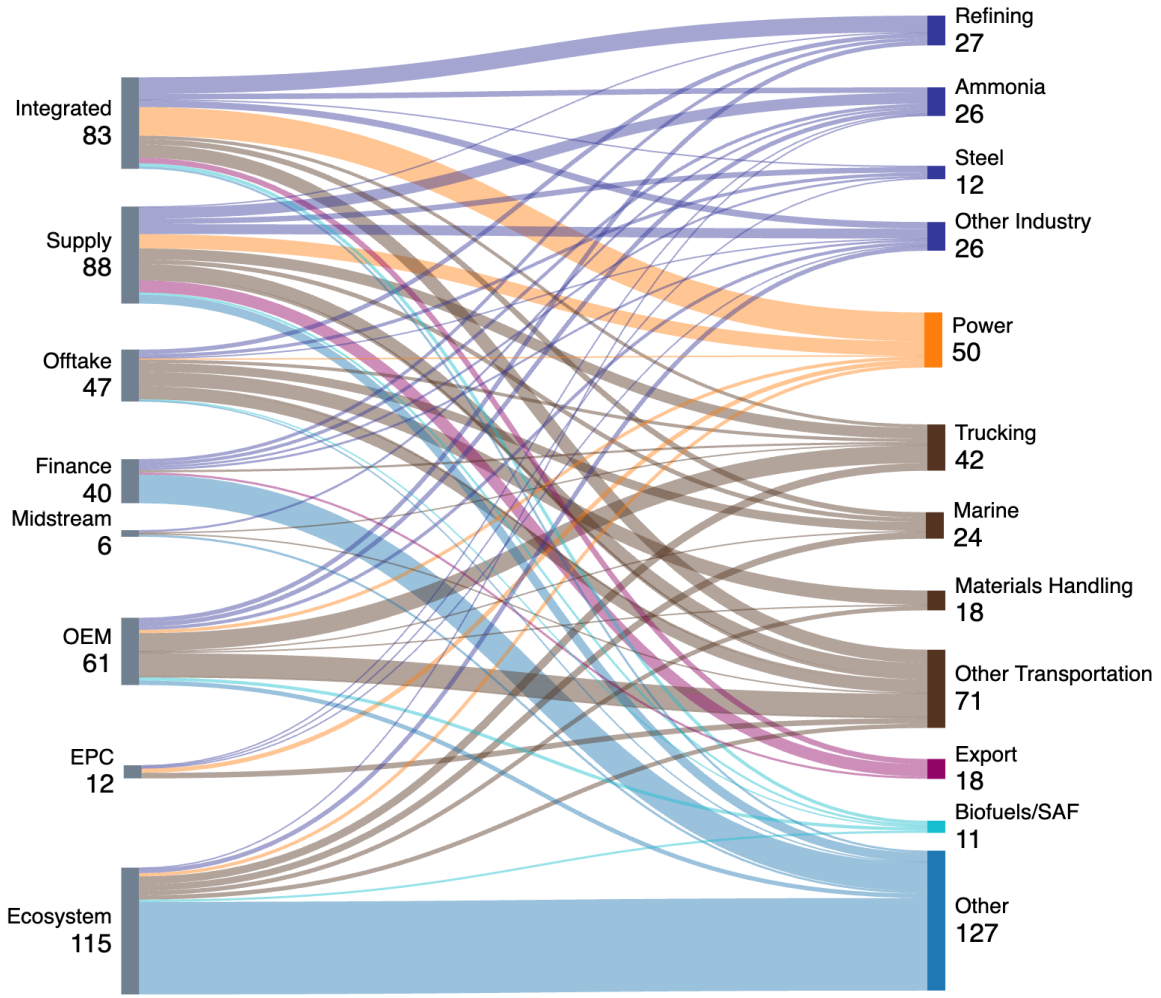
600+

engagements with

250+

organizations

Interview Breakdown by Stakeholder and End Use Sector



End uses vary across hubs, by volume, market risk, and "cost to derisk" projects

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	# of Hubs	Potential Hub TAM: existing facilities (Mtpa)[1]	DOE 2050 potential TAM (Mtpa)	Representative project vol. (tpa)	Capital need to derisk rep. proj.	Availability of green alternatives	Other factors
Materials Handling	4	0.05	N/A	50-100[2]	Low	Low	Substantial market share already, esp. in forklifts
Trucking/ HDVs	6	0.4	5-8	50-100[3]	Low	Medium (biofuels, BEVs)	Hydrogen purity requirements
SAF/ Aviation	4	0.5	2-6	30,000-200,000	High[7]	Low	Ultimate end-user W2P
Refining	3	2.7	0-6	30,000[4]	High[7]	Low	Several IDP projects
Ammonia/ Fertilizer	5	2.2	4-5	100,000	High[7]	Low	Unable to pass costs to buyers; Long term contracts with gray H2 suppliers
Steel	3	0.6	1-3	45,000-150,000[5]	High[7]	Low (DRI) to Medium (overall sector)	Ultimate end-user willingness to pay; several IDP projects
Methanol/ Shipping	1	2.2	1-3	74,000	High[7]	Medium	Potential regulatory tailwinds from EU markets
Power	6	1.0	4-8	35,000[6]	High[7]	High (storage, nukes)	Challenging economics; non-H2 alternatives exist
Residential Heating	1	1.0	1-3	--	High[7]	High (electrification)	Challenging economics; non-H2 alternatives exist

1) Unless otherwise noted, demand is based on existing and announced facilities within 150 km of hub supply project or hydrogen pipeline. Forklifts: estimate based on ~270,000 forklifts; bus/trucking: estimate based on 2% market penetration; power: estimate based on one-quarter of NG power plants replacing 10% of NG demand with hydrogen; res/comm: based on 3% blend by volume 2) 30 vehicle deployment fleet; 3) HEFA-PtL range; 4) per refinery; 5) 30%-100% H2 blend 6) Publicly available info from Delta ACES project; 7) Lower capital needed for blending projects.

H2DI narrowed from an initial list of funding "mechanisms" to a portfolio approach of four proposals in two "Tiers"

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Tier 1 | Tier 2

Sector / Segment	Mechanism	# of hubs	Ecosystem Enabling[1]	Potential for "leftover" funds[2]	Complexity	Commodity / price Risk
			Impact Potential		Administrability	
Mobility/ Transit	**Price ceiling**	7	✓	✓	■■□	■□□
	Capacity guarantee (HRS)	7	✓	✓	■□□	■□□
End-Use Agnostic	CfD	7	?	✗	■■■	■■■
	$/kg fixed adder auction	7	✓	✗	■□□	■□□
	LCFS / carbon price hedge	4	?	✓	■■□	■■■
Midstream & Storage	Capacity guarantee	3-4	✓	✓	■□□	■□□
	Oversize support	3-4	✓	✓	■■□	■□□

■□□ Low ■■□ Medium ■■■ High

✓ Yes ? Maybe ✗ No

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Preliminary Design for Joint Offtaker-Producer Auction

H2DI hopes to roll out a "Joint Offtaker-Producer Auction" as a first funding opportunity (pending approval)

Draft Timeline

End of 2024 — **T&C's Announced**
H2DI announces $460M Joint Offtaker/Producer Auction (JOPA)

Ongoing — **Auction Prep**
H2DI hosts convenings, workshops, issues reports on T&Cs, building the auction through Spring

Apr/May 2025 — **Bids Open via H2DI.Org**

July/Aug 2025 — **Bids Close**

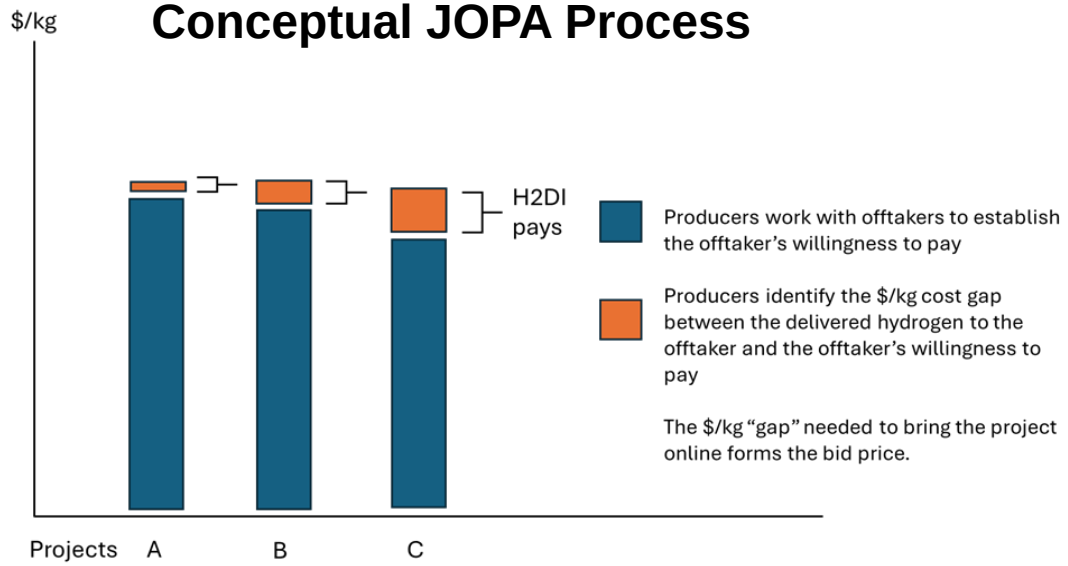
Oct 2025 — **Ineligible/eligible projects notified**

Nov 2025 — **Auction Results Announced**

Jan 2026 — **Deadline Funding Agreements Signed**
Winners sign grant agreements with H2DI, provide completion guarantee (Letter of Credit, $ is escrow, or parent guarantee) totaling 20% of total bid value.

Note that this timeline may be subject to change based on DOE guidance and feedback.

Conceptual JOPA Process



- **Type:** Fixed premium auction for clean hydrogen producers with secured commitment from external offtakers
- **Bids:** Hub producers bid the cost "gap" between supply and demand needed to develop projects
- **Budget:** $500M; max allocation per hub: 40% of budget; 10-year tenor
- **Timing:** COD within 5 years of award date

H2DI has designed a portfolio of further mechanisms to bring to market as future funding becomes available

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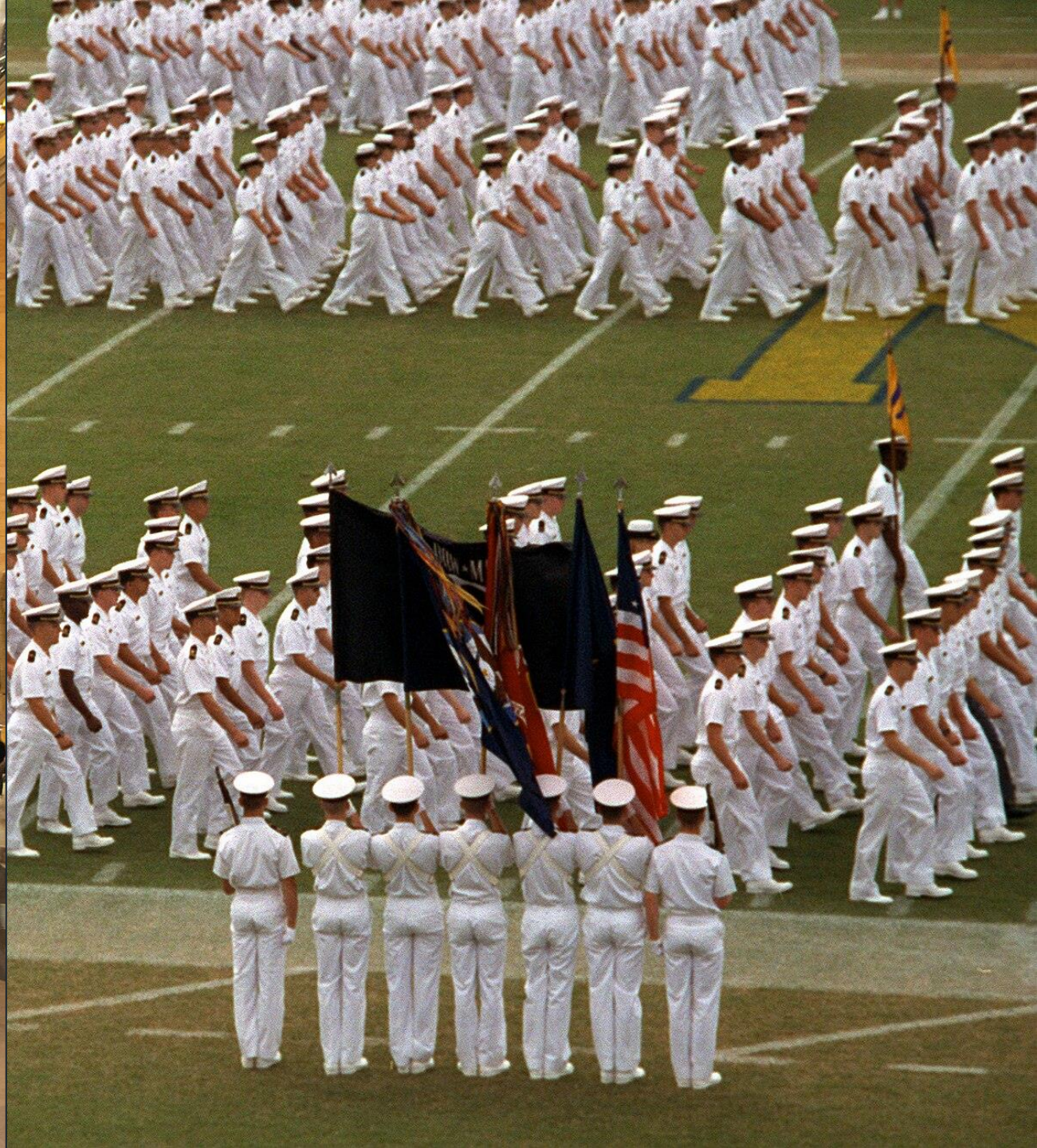
Fuel Price Ceiling Auction for Medium- and Heavy-Duty Vehicles

Finding	Design	Goals		
Mobility users are among the most market-ready new H2 adopters	H2DI guarantees max price for fuel procured by fleets	Price/ supply certainty for offtakers	Low $ per project and funding can be "reused"	Demand signal for OEMs

Capacity Guarantee for Pipelines, Storage & Refueling Stations

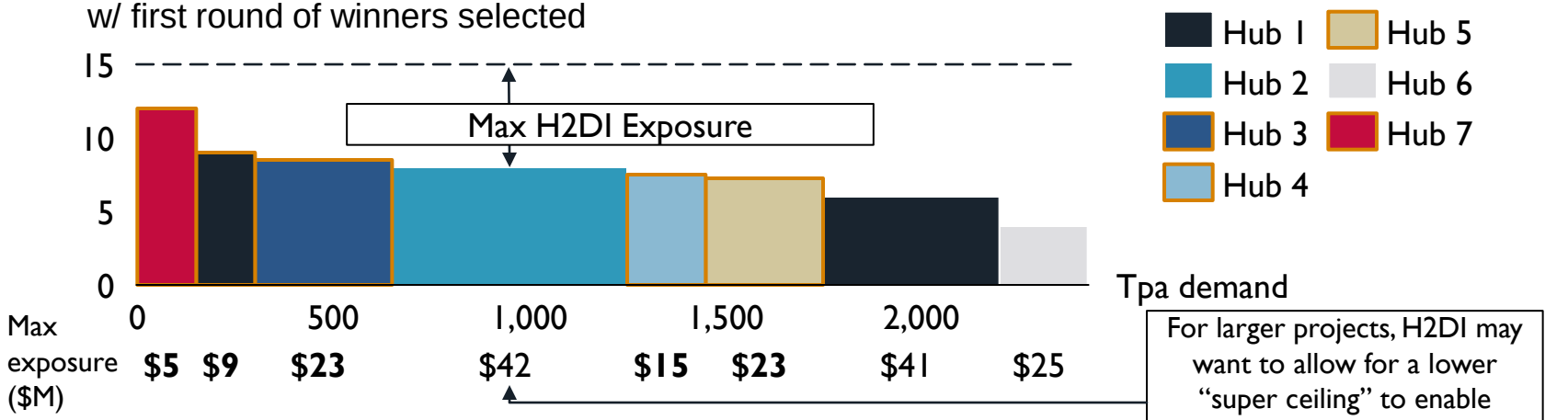
Finding	Design	Goals		
Open-access infra. could be a force multiplier and positive disruptor	H2DI buys unsold capacity of an infra. project	Derisk shared infra. projects while demand comes online	Improve and expand hub ecosystem	Provide positive signal for future demand and supply to enter region



Website: **www.h2di.org**
Contact us: **info@h2di.org**

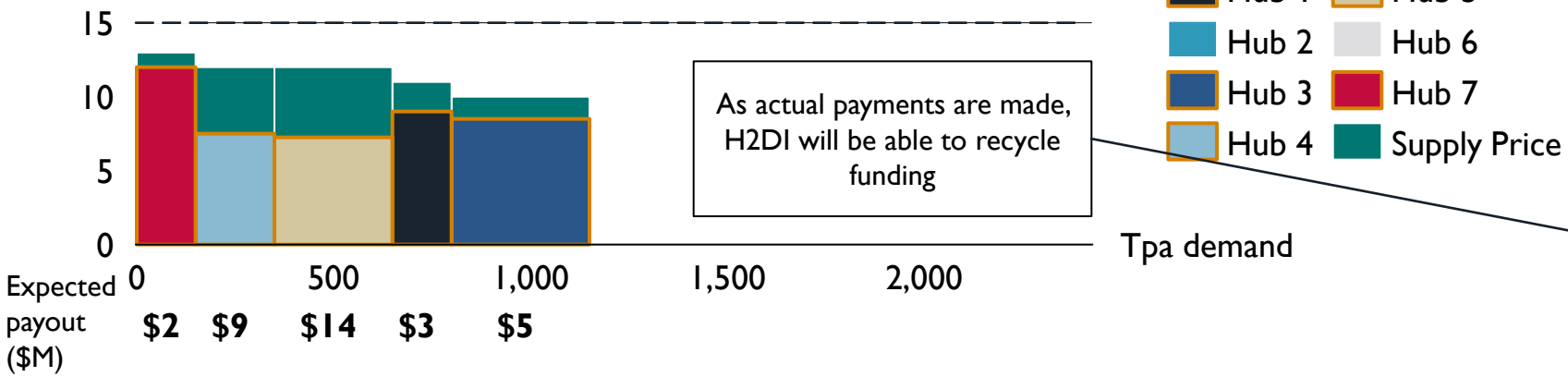
Mock Auction Example: Fuel Price Ceiling Auction

Example Fuel Price Backstop bids with $15/kg super ceiling
w/ first round of winners selected



For larger projects, H2DI may want to allow for a lower "super ceiling" to enable advancement to stage 2

First round winners with supply procurement



As actual payments are made, H2DI will be able to recycle funding

Hub	Bid	Volume (tpa)	Max exposure
7	$12/kg	150	$4.5M
1	$9/kg	150	$9M
3	$8.5/kg	350	$22.75M
4	$7.5/kg	200	$15M
5	$7.25/kg	300	$22.75M
		1,150	**$74.5M**

Hub	Bid	Volume (tpa)	Expected costs
7	$12/kg	150	$2M
1	$9/kg	150	$3M
3	$8.5/kg	350	$5M
4	$7.5/kg	200	$9M
5	$7.25/kg	300	$14M
		1,150	**$33M**

Source: S&P Global